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AUTHOR Rounds, James B., Jr.: And Others
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ABSTRACT

Using a multidimensional scaling procedure, this study examined the fit of Holland's RIASEC hexagon model to the internal relationships among the Strong-Campbell Interest Inventory (SCII) General Occupational Theme scales. SCII intercorrelation matrices for both sexes as reported in the SCII Manual were submitted, separately for each sex, to TORSCA 9 nonmetric scaling analysis. The Wakefield and Doughtie procedure was used to compare obtained TORSCA coordinates with expectations from Holland's hexagonal model. As comparison, identical analyses were performed on Vocational Preference Inventory (VPI) scale intercorrelation matrices, these data having originally served as the basis for advancing the utility of the hexagon model. For females, the SCII-hexagon fit was not good, with a near reversal of the Social and Enterprising scales. For males, the SCII-hexagon fit was very good. For either SCII or VPI scales, the female data met expectations from Holland's model less often than the male data. A replication study on SCII data for 305 female clients of a vocational assessment clinic confirmed the previously observed sex differences. Sex differences associated with the items constituting the SCII General Occupational Theme scales were hypothesized to account for the observed configual differences between the sexes. (Author/GDC)

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The Fit Between Strong-Campbell Interest Inventory General Occupational Themes and Holland's Hexagonal Model

James B. Rounds, Jr., Mark L. Davison, and

René V. Dawis

University of Minnesota

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Please send all correspondence to James B. Rounds, Jr., Department of Psychology, Elliott Hall, University of Minnesota, 75 East River Road, Minneapolis, Minnesota 55455.

Running Head: SCII-Holland Fit

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Abstract

Using a multidimensional scaling procedure, the present study examined the fit of Holland's RIASEC hexagon model to the internal relationships among the Strong-Campbell Interest Inventory (SCII) General Occupational Theme scales. SCII intercorrelation matrices for both sexes as reported in the SCII Manual were submitted, separately for each sex, to TORSCA 9 nonmetric scaling analysis. The Wakefield and Doughtie procedure was used to compare obtained TORSCA coordinates with expectations from Holland's hexagonal model. As comparison, identical analyses were performed on Vocational Preference Inventory (VPI) scale intercorrelation matrices, these data having originally served as the basis for advancing the utility of the hexagon model. For females, the SCII-hexagon fit was not good, with a near reversal of the Social and Enterprising scales. For males, the SCII-hexagon fit was very good. For either SCII or VPI scales, the female data met expectations from Holland's model less often than the male data. A replication study on SCII data for 305 female clients of a vocational assessment clinic confirmed the previously observed sex differences. Sex differences associated with the items constituting the SCII General Occupational Theme scales are hypothesized to account for the observed configural differences between the sexes. Sex differences in the structure of vocational preferences are discussed.

The Fit Between Strong-Campbell Interest Inventory General Occupational Themes and Holland's Hexagonal Model

Scales to measure similarity to Holland's (1966, 1973) personality types have been constructed from the Strong Vocational Interest Blank (SVIB), separately for females (Hansen & Johansson, 1972) and for males (Campbell & Holland, 1972; Holland, Blakeney, Matteson, & Schnitzen, 1974; Matteson, Holland, Blakeney, & Schnitzen, 1973). With the development of a combined-sex form of the SVIB--the Strong-Campbell Interest Inventory (SCII; Campbell, 1977)--one set of Holland scales, the General Occupational Themes, was constructed for use with both females and males. Holland scales were constructed for the SVIB and SCII to provide a framework for organizing and interpreting the Basic Interest and Occupational scale scores as well as to provide measures of Holland's personality types (Campbell, 1977; Campbell & Holland, 1972).

The SVIB Holland scales had been used primarily in research and not in counseling practice. However, the SCII (the revised SVIB) presents to counselors and other users a standard-score printout of the six Holland scales (the General Occupational Themes) which users are instructed to interpret as measures of Holland's personality types. In some instances, the printout provides users with descriptions of the Holland personality types (see Campbell, 1977, p. 17, 19). Similarly, the SCII Manual (Campbell, 1977, p. 34) refers counselors to Holland's theoretical descriptions of the personality types (Holland, 1966, 1973) for the interpretation of the SCII General Occupational Theme scores. It becomes important, therefore, to investigate the basis for such interpretation. The purpose

of this study specifically is to examine the fit of Holland's hexagonal model of six personality types to the six SCII Holland scales.

Holland (1973) posits that there are six personality types--Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C)--and that they are so related as to be represented as a hexagon. The six personality types are ordered R-I-A-S-E-C in a clockwise direction around the hexagon. The hexagonal model defines the internal relationships among the personality types such that the distances between the types are "inversely proportional to the theoretical relationship between them" (Holland, 1973, p. 5), i.e., that adjacent types on the hexagon are most related, while opposite types are least related, and alternating types are of an intermediate level of relationship.

A number of studies (Campbell, 1977; Hansen, 1974, 1977; Lunneborg, 1977; Utz & Korben, 1976) have examined the construct validity of the SCII Holland scales. These authors have reported that their results generally conformed to expectations from Holland's theory. However, some results indicated that the internal structural relationships among the SCII Holland scales differed for females and males and that the structure for females differed somewhat from Holland's hexagon model. For example, Utz and Korben (1976) reported that only 50% and 33% of predicted relationships reached statistical significance for males and females, respectively. Hansen (1974, 1977) assigned Holland codes to the SCII items and found few items ($\leq$ 6) representing the Realistic, Investigative-Conventional, Investigative-Social, and Social-Realistic types for females,

while for males the types represented by few items were Conventional, Artistic-Enterprising, Investigative-Conventional, and Social-Realistic.

Campbell (1977) presented SCII Holland scale intercorrelations to demonstrate that these scales could be ordered according to Holland's hexagon model. However, Campbell failed to note that some of these correlations, those involving the Artistic, Social, and Enterprising scales for females and the Social and Enterprising scales for males, were inconsistent with Holland's RIASEC ordering. Also, some of the intercorrelations were quite high, in some instances almost as high as correlations between measures of the same Holland personality type (see Horton & Walsh, 1976, for data on females, and Gaffey & Walsh, 1974, for data on males).

The present study examines the fit of the correlations among the SCII Holland scales, for females and males separately, to Holland's RIASEC hexagon model. To assess the planar fit, the correlations were analyzed by multidimensional scaling (MDS). To assess theoretical consistency, the resulting scale values from the MDS analysis were analyzed by the Wakefield and Doughtie (1973) procedure (see below). For comparison purposes, Vocational Preference Inventory (VPI) intercorrelation matrices for both sexes were also submitted to the MDS analysis. This secondary analysis partially replicates previous studies (Cole, 1973; Cole & Hanson, 1971; Cole, Whitney, & Holland, 1971) using a different method, a research activity advocated by Bryant and Wortman (1978).

Method

Instruments. The six Strong-Campbell Interest Inventory General

Occupational Theme scales (Campbell, 1977) consist of 120 items, 20 items per scale, most of the items being occupational titles. Each item is scored +1, 0, or -1 for, respectively, a "Like," "Indifferent," or "Dislike" response. Scale scores, the sum of item scores, are converted to standard scores based on either same-sex or combined-sex General Reference Samples.

The six Vocational Preference Inventory scales (Holland, 1965) consist of 84 items (occupational titles), 14 items per scale. Subjects check (Yes or No) those titles that interest them. Scale scores are obtained by summing the Yes responses.

These six SCII and six VPI scales correspond, of course, to Holland's six personality types.

Data. Correlation matrices for the SCII and VPI Holland scales, separate matrices for females and males, comprised the basic data for the present study. Intercorrelations of the six SCII Holland scales, based on samples of 201 females and 200 males, were obtained from Campbell (1977, p. 34). Intercorrelations of the six VPI scales, based on samples of 2,433 females and 1,234 males, were obtained, respectively, from the ACT Guidance Profile Manual (American College Testing Program, 1968, p. 29) and Holland (1973, p. 23). The VPI correlation matrix given in Holland (1973, p. 23) is based on a 10% sample of 12,345 male two-year college freshmen, not "on both sexes together" as reported by Feldman and Meir (1976, p. 351). These correlations were also given in Holland, Whitney, Cole, and Richards (1969, p. 4).

Procedure. The SCII and VPI correlation matrices were submitted to

the TORSCA 9 nonmetric scaling program (Young & Torgerson, 1967). The TORSCA nonmetric scaling analysis uses a similarity matrix (in this case, a correlation matrix) as the source of information about relationships among the variables (SCII or VPI scales). It attempts to find a spatial configuration of the variables such that the distances between the variables in the spatial configuration are, as nearly as possible, an inverse monotone function of the correlations among the variables. By this method, the relationships among the variables are represented graphically in an n-dimensional space, that is, the spatial distance is an analogue of the similarity as measured by the correlation coefficient.

The goodness of fit (or badness of fit) of the TORSCA solution (fit of obtained stimulus coordinates with the original similarity matrix) is expressed by Kruskal's (1964) stress values. The higher the stress values the poorer the fit; that is, a high stress value means that the distances between pairs of variables in the n-dimensional spatial configuration poorly reproduce the rank order of the correlations between pairs of variables.

The theoretical consistency of the SCII and VPI configurations was analyzed by the Wakefield and Doughtie (1973) procedure. According to these authors, the hexagon model specifies that the distances between opposite types (there are three such distances) should be greater than the distances between alternating types (six distances), which in turn should be greater than the distances between adjacent types (six distances). Therefore, distances between alternating types can be compared with those of adjacent types (36 comparisons) and with those of opposite

types (18 comparisons), and the number of comparisons observed as occuring in the hypothesized direction can be compared with that expected by chance. Since the probability of a comparison being in the predicted direction by chance is .5, use of the binomial distribution tells us that at least 34 of the 54 comparisons must be in the predicted direction to warrant rejection (at $p \leq .05$) of the hypothesis of random arrangement of the six types.

Results

TORSCA solutions were obtained in one through three dimensions for the SCII and VPI correlations. Kruskal stress values for one through three dimensions were: (a) for females, .106, .062, .000 for the SCII data and .207, .039, .000 for the VPI data; and (b) for males, .225, .030, .002 for the SCII data and .273, .000, .000 for the VPI data. The stress values indicated that a two-dimensional representation of the data was appropriate for the male SCII and male and female VPI data but less appropriate for the female SCII data. Nonetheless, Table 1 shows the two-dimensional solution for the female and male SCII and VPI data.

Insert Table 1 about here

Table 1 and Figure 1 show the TORSCA solution for the female SCII and VPI data. The arrangement of the SCII and VPI scales (read clockwise) conforms to Holland's RIASEC ordering. However, as seen in Figure 1, the shape of the hexagons is not symmetrical, especially with the SCII-Social and VPI-Enterprising scales being located near the center of the figure. The SCII scales are plotted near the same-named VPI scales with two

exceptions. The SCII-Social scale is plotted next to the VPI-Enterprising scale and SCII-Enterprising is plotted next to VPI-Social.

Insert Figure 1 about here

As shown in Table 1 and Figure 2 the TORSCA solution for the male SCII and VPI data support an RIASEC ordering of the scales, and the shape of the SCII and VPI configurations approximates a symmetrical (or equilateral) hexagon. Also, the coordinates (scale values) for the same-named SCII and VPI scales are very similar, with the exception of the Artistic scales.

Insert Figure 2 about here

Superimposing the four TORSCA solutions (see Figure 3), shows that the same-named female and male SCII and VPI scales cluster together (with some exceptions), arranging themselves in the RIASEC ordering. Figure 3 highlights the three exceptions to correspondence with Holland's hexagonal model. The female SCII-Social scale clustered with the male SCII-Enterprising scale and the female and male VPI-Enterprising scales. The female SCII-Enterprising scale clustered with the male SCII-Social scale and the female and male VPI-Social scales. Finally, the male VPI-Artistic scale did not cluster with the same-named female SCII and female and male VPI scales but was located almost midway between the positive end of axis 1 and the negative end of axis 2.

Insert Figure 3 about here

The theoretical consistency analysis supported the findings from the TORSCA analysis. The hypothesis of random arrangement of the SCII and VPI scales was rejected for both female and male data. The SCII scales for the male sample were the most consistent, with 50 of the 54 comparisons in the predicted direction. The SCII scales for the female sample were the least consistent, with 38 of the 54 comparisons in the predicted direction. For the VPI scales, 43 of the comparisons for the female sample and 48 of the comparisons for the male sample were in the predicted direction. Most of the inconsistencies involved the Realistic-Social and Investigative-Enterprising opposite types.

In view of the finding of apparent sex differences in the SCII analysis, a partial replication study was conducted using SCII data obtained on 305 female clients of a vocational assessment clinic. This sample had a mean age of 31.8 years; 58% of the sample had a college degree or higher, and 56% were employed full-time. Table 2 shows the intercorrelation matrix, means and standard deviations for the six SCII General Occupational Theme scales for this sample. The intercorrelation matrix was subjected to a TORSCA analysis, as before. The Kruskal stress values were .000 for both one- and two-dimensional solutions, indicating that a one-dimensional representation was most appropriate for the data. However, both one- and two-dimensional solutions are presented in Table 3. As Table 3 shows, the one-dimensional solution is degenerate and should not be interpreted. The two-dimensional solution, plotted in Figure 4, shows that the relationships among the six scales, for this sample, might better be represented by a square than by a hexagon.

Insert Tables 2, 3, Figure 4 about here

Discussion

The SCII General Occupational Theme (Holland) scales are being interpreted as measures of Holland's personality types; however, the correspondence between Holland's hexagon model and the internal relationships among the SCII scales has not been tested. The results of the present study indicate that for males the interrelationships among the SCII scales conform to Holland's hexagon model. For females, however, the results provide much more modest support for the SCII's fit with the hexagon model.

The present analysis highlighted some notable differences between female and male configurations for the SCII Holland scales. The Social, and Enterprising scales for females clustered, respectively, with the Enterprising, and Social scales for males. The transposition of the Social and Enterprising scales for the female data resulted in the Investigative scale being opposed to the Social rather than the Enterprising scale. Further, the Social scale mediated the opposing themes of Realistic vs. Enterprising and Artistic vs. Conventional. The differences between female and male SCII configurations were the same differences between the female SCII configuration and the female and male VPI configurations.

Other sex differences involving the SCII Holland scales have been reported in several studies. Lunneborg (1977) correlated the SCII Holland scales with the Vocational Interest Inventory (VII) scales separately for female and male samples. For females the SCII-Enterprising scale correlated -.23 with VII-Technical and .01 with VII-Science, compared with correlations

of .03 and -.21, respectively for males. The SCII-Conventional scale correlated -.07 with VII-Technical and .16 with VII-Science for females compared with correlations of .34 and -.06, respectively, for males. Utz and Korben (1976) found that EPPS-SCII correlations differed for females and males (only 23% of the predicted EPPS-SCII correlations were observed in common for both female and male samples).

There is some reason to believe that the difference between female and male SCII MDS structures for the SCII data is related to sex differences associated with the items constituting the General Occupational Theme scales. Results from Hansen's (1974) analysis of SCII items seem to support this interpretation. Correlations among the New Holland scales (SCII items grouped according to Holland codes) and correlations between the New Holland scales and the General Occupational Theme scales similarly showed differences between female and male samples. Hansen (1974) found that the content of the New Holland scales differed for females and males, in part, "because of the small number of identically coded female and male items" (p. 47). Only 12% of the SVIB-SCII items (27 items) answered by both the female and male samples were assigned identical Holland codes. Eleven SCII items with dissimilar Holland codes for the sexes, five SCII items which were uncodable for females, and three which were uncodable for males, are included in the General Occupational Theme scales.

In stressing the continuity between the SVIB Holland scales and the SCII Holland scales, Campbell (1977) reports that "in most instances the SVIB and SCII Holland scales are nearly identical" (p. 33). Unfortunately, Campbell fails to note that "nearly identical" refers only to the male

SVIB Holland scales. A comparison of the item content for the female and male SVIB Holland scales with the corresponding SCII scales showed that 90% (108 of 120 items) of the male but only 69% (83 of 120 items) of the female SVIB Holland scale items were essentially identical with the SCII scale items. To compound the problem, item differences between the female SVIB and SCII Holland scales were not equally distributed across the six scales. Approximately 60% of the items for the Realistic and Enterprising female SVIB scales were different from the same-named SCII scales.

It appears, then, from the findings just discussed that the items selected to represent the Holland personality types in the SCII do not do so in an equivalent manner for females and males. The same item sets apparently do not have identical meanings for both sexes. This would explain in large part the somewhat different internal structures observed between the sexes as a result of multidimensional scaling analysis.

In summary, the present study examined--for each sex--the fit of the SCII Holland Scales (General Occupational Themes) to the Holland hexagon model by means of a multidimensional scaling approach. Multidimensional scaling has not been used in this connection except by Meir (Feldman & Meir, 1976; Meir & Ben-Yehuda, 1976). (For other methods, see Cole & Cole, 1970, and Lunneborg & Lunneborg, 1975). The study likewise examined the fit of the VPI scales using the same multidimensional scaling method, again for each sex. This enabled the direct comparison and consideration of the correspondence in internal structure between the two sets of Holland scales, and between the sexes. The findings of the present analyses confirm previous conclusions (Cole & Hanson, 1971; Cole, Whitney, & Holland, 1971; Edwards &

Whitney, 1972) that male responses to Holland scales fit the RIASEC hexagonal model. The present findings also confirm other results (Feldman & Meir, 1976; Utz & Korben, 1976) that female responses to Holland scales fit the RIASEC hexagonal model less well. However, the present study does not confirm Feldman and Meir's (1976) contention that the model for females is IRASEC. Neither does the present study (including the replication study of female clients) show that a symmetrical equilateral hexagon is the best fit. For the SCII-manual data, R, I, A, and C defined four points of the hexagon as predicted by theory, but S and E did not clearly define the fifth and sixth points. For the replication data, R, A, S, and C defined four points well, but I and E did not.

Thus, the present study suggests some caution in the interpretation for females of scores on the SCII General Occupational Themes in terms of the set of contrasts and descriptors typically being used to describe the Holland personality types (see, e.g., Campbell, 1977), especially since in the first place little evidence exists to support such use for either females or males (Johnson, 1976). Perhaps counselors should consider using the female and male personality decriptors provided by Utz and Korben (1976), which are based on empirical data. The present study also suggests that vocational interests as measured by the SCII General Occupational Themes may be interpretable in the context of Holland's theory for males, but further study is needed before the same can be done for females.

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Footnotes

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Requests for reprints should be sent to James B. Rounds, Jr., Department of Psychology, Elliott Hall, University of Minnesota, 75 East River Road, Minneapolis, Minnesota 55455.

Table 1

Two-Dimensional TORSCA Solutions for

the SCII and VPI Holland Scale Data, by Sex

Holland	Female				Male			
Scale	SCII		VPI		SCII		VPI	
Dimension	1	2	1	2	1	2	1	2
Realistic	.082	.603	.003	.475	.089	.622	-.171	.638
Investigative	-.458	.319	-.534	.324	-.447	.245	-.659	.360
Artistic	-.883	-.118	-.780	-.143	-.829	-.302	-.412	-.635
Social	.239	-.140	.077	-.562	.064	-.574	.099	-.404
Enterprising	.322	-.595	.333	-.105	.571	-.222	.513	-.193
Conventional	.697	-.069	.901	.010	.552	.231	.631	.234

Table 2

Intercorrelations, Means, and Standard Deviations

for the Six SCII Holland Scales,

for a Female Client Sample (N=305)

Holland Scale	R	I	A	S	E	C	M	SD
Realistic	--	.62	.25	.10	.19	.24	44.44	9.66
Investigative		--	.43	.23	.21	.23	47.12	9.77
Artistic			--	.20	.13	-.16	54.81	8.78
Social				--	.33	.24	49.42	9.46
Enterprising					--	.48	50.31	8.73
Conventional						--	47.29	9.30

Table 3

One- and Two-Dimensional TORSCA Solutions

for the SCII Holland Scale Data

for a Female Client Sample (N=305)

SCII Holland Scale	One-dimensional	Two-dimensional	
Dimension:	1	1	2
Realistic	.645	.033	.630
Investigative	.645	.361	.344
Artistic	.645	.773	.056
Social	-.645	-.039	-.668
Enterprising	-.645	-.451	-.380
Conventional	-.645	-.677	.091

Note. Stress = .000 for one- and two-dimensional solution.

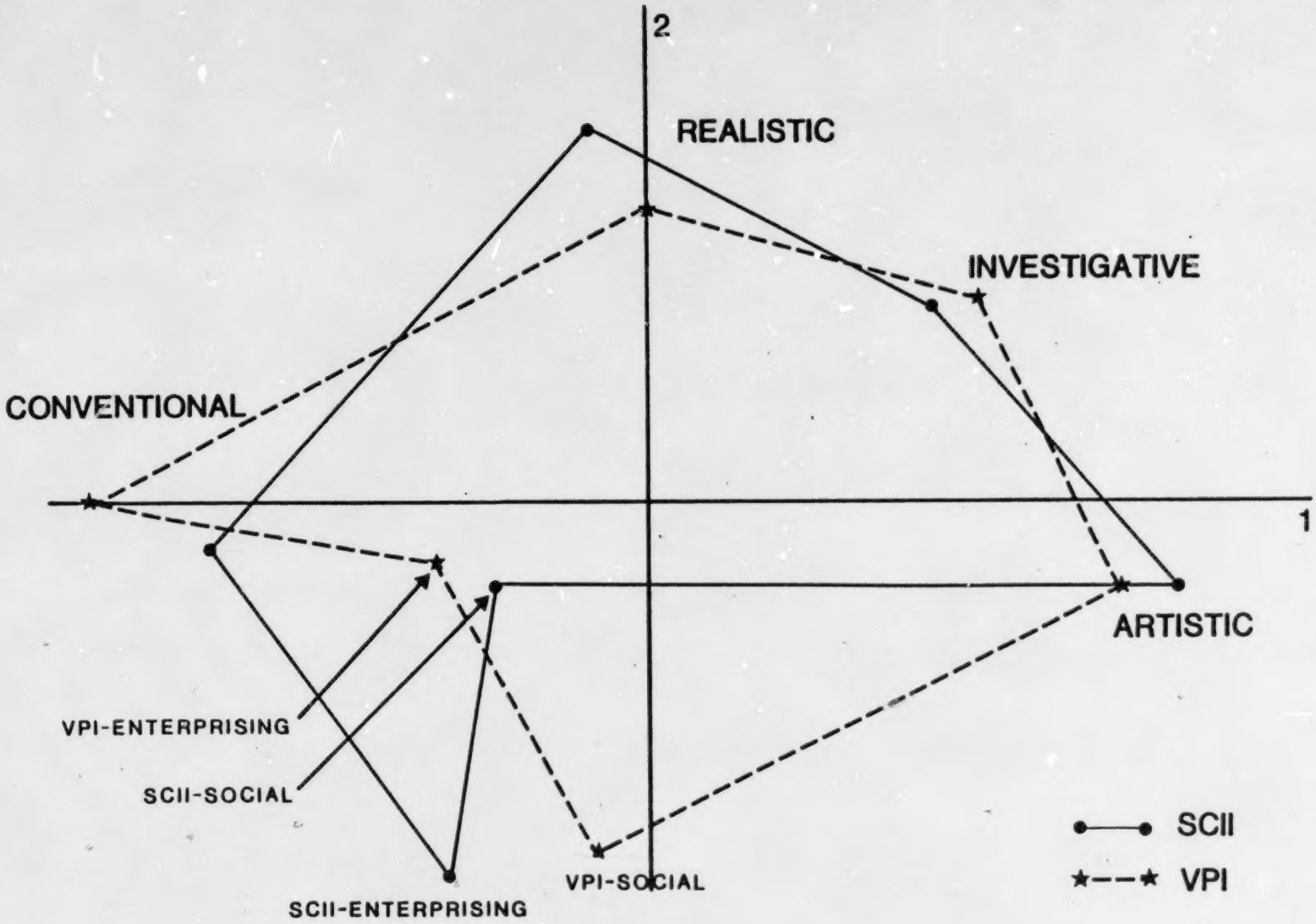

Figure 1. Two-dimensional configurations for females obtained from the SCII and VPI scale correlations (stress = .062 for SCII and .039 for VPI).

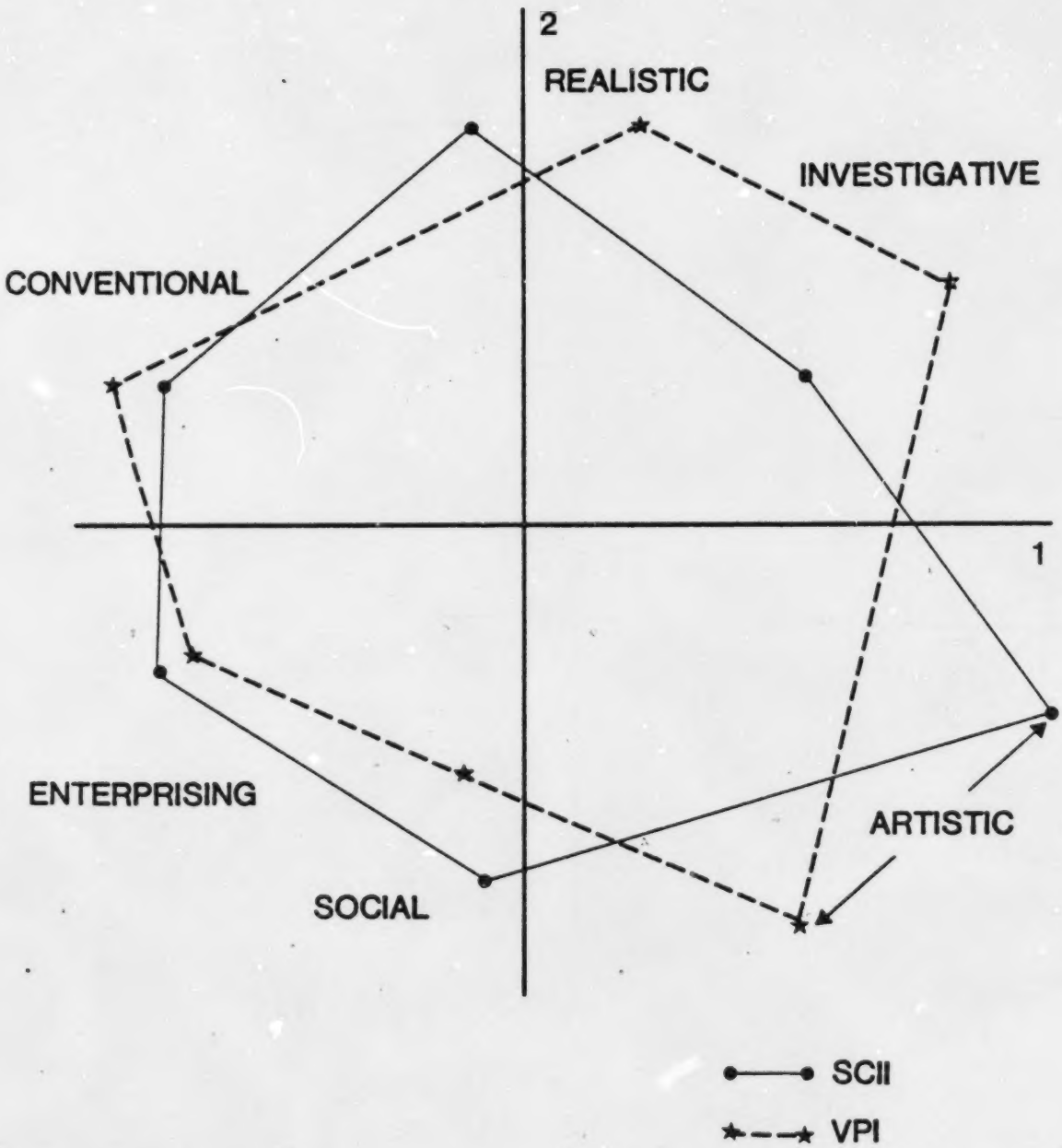

Figure 2. Two-dimensional configurations for males obtained from the SCII and VPI scale correlations (stress = .030 for SCII and .000 for VPI).

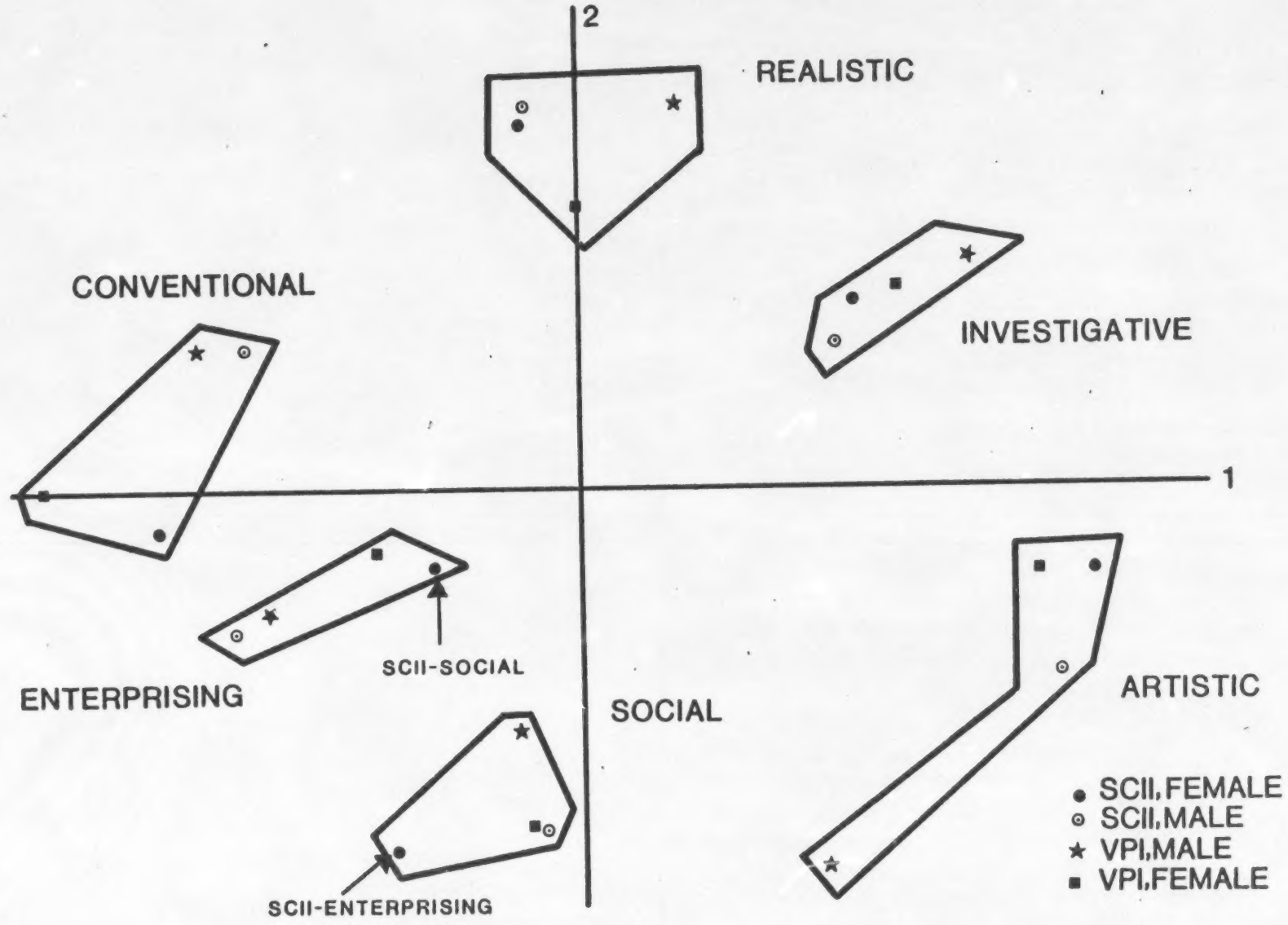

Figure 3. Plot of SCII and VPI scale values for females and males.

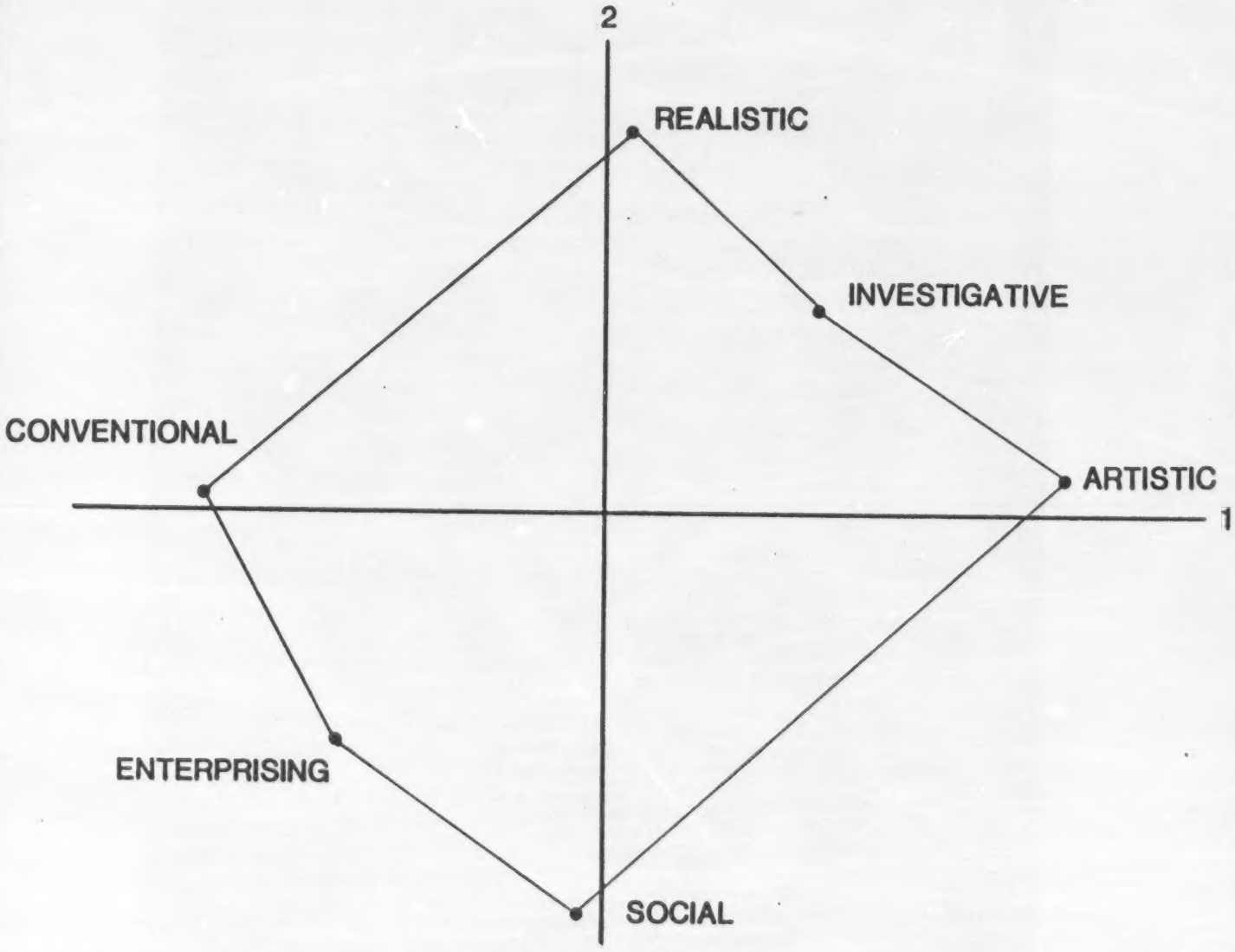

Figure 4. Two dimensional configuration for females obtained from SCII scale correlations (stress = .000) for a sample of 305 female clients.